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ABSTRACT

This report describes the interactive structure and questioning patterns used by 20 preservice teachers using Smith's AUTHOR system to create interactive videodisc modules on earth science topics. Results indicate three forms of questioning were used, although multiple-choice questions were used two-thirds of the time. Interaction was defined in terms of presentation of information and asking questions. Presentation of information occurred through text on the screen of the microcomputer and single frames or movie clips shown on the videodisc monitor. Multiple-choice and essay-type questions were used by the student authors to call for overt interaction by pupils using the programs. Supporting data are presented in two tables and four figures. (26 references) (Author/BBM)

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Preservice Teachers Use Authoring System To Create Interactive Videodisc Instruction

by

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Abstract

Describes the interactive structure and questioning patterns used by 20 preservice teachers using Smith's AUTHOR system to create interactive videodisc modules for earth science topics. Results indicate three forms of questioning, although multiple-choice questions were used two-thirds of the time. Interaction was defined in terms of presentation of information and asking questions. Presentation of information occurred through text on the screen of the microcomputer and single frames or movie clips shown on the videodisc monitor. Multiple-choice and essay-type questions were used by the student/authors to call for overt interaction by pupils using the programs. (Keywords: authoring, interactive videodisc instruction, questioning, computer assisted instruction)

The videodisc is a recent entry in the array of media designated to support instruction. From 1970 until 1984 there was intense rivalry between RCA's Selectavision and Philip's laser disc players to establish a standard for the videodisc player (Buddine & Young, 1987). Philip's prevailed in that 15-year contest, but during the fray the 5-inch compact disc emerged as a formidable competitor for dominance in the laser disc marketplace. We now have two primary forms of laser disc - the large, 12-inch videodisc and the small 5-inch compact disc. The former has been a source of high quality video used in interactive videodisc (IVD) instruction and the latter has been very successful in replacing the standard phonograph albums of music.

Interactive videodisc (IVD) programs have been used during the 1980's to support delivery of instruction in foreign languages (Williams, 1983), in teaching core concepts of mathematics (Peterson, Hofmeister & Lubke,1988), in adult literacy training programs (Meenan & Burns,1987), in teaching titration to high school chemistry students (Stevens, Zech, & Katkanant,1988), in developing human relations skills needed by unemployed workers seeking new employment (Bailey, 1988), and a number of other applications could be cited.

A recent summary of publications and research reports (Helsel, 1988) indicated that introduction of IVD players in public schools has increased from 2000 players in 1985 to 35,000 units in 1988. This remarkable growth in the number of players available for instruction is echoed by the *Directory of the Minnesota Educational Computing Consortium* (MECC, 1988) which reported 150 discs available for instruction in 1985 and more than 300

videodiscs were available for instruction in 1988. Furthermore, videodisc players for instruction cost about $3500 apiece in 1980, in contrast to the recent price of $590 for Pioneer's videodisc player which was displayed at the Nebraska Videodisc Symposium for Education in 1987 (Helsel, 1988).

An important feature of this crescendo of interest in IVD instruction was the development of authoring systems, which were intended to enable teachers to develop IVD modules to support their regular instructional program and to be able to do this without having to acquire programming skills in BASIC, Pascal, C, or any other high level computer programming language (Edwards, 1986; Smith, 1987a).

It is too early to determine which of the 100 or more authoring systems will survive the critical scrutiny of each system by the user community of teachers, pupils, administrators, and other researchers. Criteria for evaluating the authoring systems have been suggested by several individuals and organizations, e.g., (Locatis & Carr, 1985; Huntley, Alessi & Terpstra, 1986; Burger,1986; Hillesohn,1984).

In addition, the laser disc technology continues to increase its capacity and applications. Advocates of the compact disc have moved from remarkable accomplishments in music to recording archival copies of large data bases, e.g., ERIC, Psychological Abstracts, Medline, (Lambert, 1986). Researchers are now successfully storing and retrieving video, audio, and text from the surface of a 5-inch compact disc, which was previously limited to storing digitized text (Brewer, 1988). Atkinson's development of hypercard for the Macintosh microcomputer is being implemented by Optical Data Corp. in the form of Lasercards for use with their videodiscs in the physical and biological sciences (Optical Data, 1987). Apple has produced their compact

disc player with direct linkage of hypercard stacks to the Macintosh microcomputers (Strukhoff, 1988). It is evident that another round of intense competition is underway.

PROCEDURE

This paper provides a descriptive summary of the use of an interactive videodisc(IVD) system by a group of 20 preservice teachers. The *Earth Science* videodisc, developed at the Center for Aerospace Education (Clark, 1985), was used by these students to create original IVD modules. The students were juniors or seniors in the Wayne State College of Education and had never used IVD as a student or instructor. They were expected to select some earth science topic as it was developed in a science textbook for elementary, middle school or high school pupils. They were to assume that the chapter had been part of a unit of instruction, which had continued for two or three weeks.

Their task was to select one concept or generalization about earth science which was presented in the chapter of a current science textbook for elementary or secondary school pupils. Each student was to view the *Earth Science* videodisc to identify single frame illustrations or movie clips which were related to that concept. Finally, the student was to write a computer assisted instruction module which would provide reinforcement of the pupil's understanding of the concept or their module would provide enrichment of a pupil's understanding of the concept previously developed in the instruction.

The students used Smith's AUTHOR System (Smith,1988a) to create their original modules of interactive videodisc(IVD) instruction. That system

had been developed during 1985-1988 with funding from UNISYS Corporation (formerly Burroughs Corporation), using their B-25 microcomputers. However, the authoring system was subsequently written to be compatible with IBM/AT clones using MS-DOS 3.1 or for use with the Macintosh Plus. It is only one of many similar systems, which are intended to support teachers in using IVD without requiring them to acquire skills in computer programming.

The collection of options for the student/author is shown in Table 1. Discriminating use of these options permits the student/author to present text on the microcomputer's screen, show one picture or an extended motion picture sequence, and branch to different parts of the program as may be required. This list of authoring options in the table is not remarkable in any sense, because the majority of the IVD authoring systems provide similar or more elaborate authoring techniques.

In practice, the student would reserve lab time for a block of 45 minutes or more to use the videodisc to identify scenes, jot down tentative questions or frame numbers, and record similar aspects of the emerging lesson. Ordinarily, this process was accomplished using the hand controller of the videodisc player and the printed catalog of frame numbers and movie clips which accompanied the videodisc.

After gathering this information about suitable illustrations and doing background reading for the topic, the student/author began to write a draft of the module. A manual with sample forms was provided to assist the student/author in assembling different types of questions, responses to correct or incorrect replies, displaying single pictures or movie clips (Smith,1988b). They were also able to review examples of IVD modules which previous students had completed with varying degrees of success.

The student/authors spent 5 to 7 hours of lab time viewing selections from the videodisc, entering their individual programs using the authoring system, editing the text, and conducting trial runs of the program. Approximately the same amount of time had been expended in reading and preparing the program to be entered.

RESULTS

The results are presented with respect to two areas: 1) different levels of interaction provided by the IVD program, and 2) types of questions presented by the program.

Levels of Interaction The student/author's program was to present information to the learner through text or figures appearing on the microcomputer's screen and through the single frame or movie clips with illustrations and sound extracted from the vidoedisc and displayed on the IVD monitor. Although interaction occurs between the learner's thoughts and the visual or auditory stimuli presented on the screen, we consider this to be a presentation of information which the learner passively receives.

Interaction can be observed to occur when the program asks or requires the pupil to do something at the keyboard. Smith's AUTHOR system provides options for multiple-choice or essay-type replies to questions, which may be acknowledged as "right" or "wrong" or simply be accepted without evaluative discussion.

Therefore, the level of interaction in the total instructional program may be estimated in terms of the number of program sections in which information is presented and the number of sections where questions call for

a pupil's active response. We have adopted a narrow interpretation of interaction. We regard the presentation of information as a passive or receptive mode for the pupil. We consider the question and answer process as an overt sign of interaction between the pupil and the ideas contained in the programs.

Given this model of interaction, Figure 1 illustrates one pattern of a student/author program in which the presentation of information is contrasted with interactive questioning. As shown in the figure, the program starts with an alternation between text information presented on the microcomputer screen and a related illustration selected from the videodisc and shown on the IVD monitor. This pattern continues for almost two-thirds of the program, and then a flurry of multiple-choice questions occur and the program concludes with three essay-type questions. As shown in the figure, a movie clip is never used.

The bar graph in Figure 2 show a second pattern in which the program provides a sequential balance of: a) presentation of text, b) display of single frame or movie clips , and c) multiple-choice or essay-type questions. The pattern continues throughout this student/author's program.

Figure 3 illustrates another pattern in which the answers to questions are found exclusively in the videodisc movie clips. As shown in part A of the figure, the movie clip displays frames 8085 through 9826, and three questions (Q1, Q2, Q3) were asked about the ideas presented in the movie. In part B, a second movie segment was shown, frames 9852 through 12181 and four additional questions were asked about the content of the movie. In part C of the figure, a third movie segment was shown, frames 12190 through 15703, and questions were related to specific single frame

illustrations in the movie.

Figure 4 shows an IVD program which used three separate videodisc movie segments to present information as well as substantial sections of text presented on the microcomputer's screen. As shown in the figure, information was coordinated from these two sources (IVD monitor and micro's monitor) to present information prior to asking questions Q1 through Q8. Only the microcomputer screen was used by the student/author to present text information for questions Q9 through Q14.

Figures 1 through 4 provide a graphic means to enable student/authors to visualize the structures of their IVD programs.

Types of Questions The student/authors had two major options for questioning -- multiple-choice or essay-type questions. Their use of the multiple-choice format fell into two sub-categories. In one case, the question would present a complete statement, and the pupil was expected to select the preferred answer from a set of one-word options. A variation of this occurred when the choice of the "correct" answer was to be selected from a set of phrases of two or more words. Another variation of this format called upon the pupil to choose the best of several complete sentences as the correct response. Obviously, when more words and concepts are introduced into a question, this increases the difficulty of the task for the pupil.

There was a second variation of the multiple-choice format which was very similar to the preceding form; however, in this instance a specific question was presented instead of a statement. Once again, the pupil was expected to select from options which might be one-word options, phrases with several words each, or options which might include several complete

sentences.

Among the essay-type or open-ended questions used by these student/authors, we also found three types. Smith's AUTHOR system permits the respondent to type three or more screens of information in response to an essay-type question, so there was not a serious limitation of space to constrain the student/author. The first type of essay question required the pupil to **name** something. The task might be to match a single term to a statement or definition. The task might ask the pupil to name two or more traits or characteristics of some situation. The pupil might be required to name the events which occurred in some situation or process. This level of questioning appeared to simply call for a restatement of some term or terms which had been presented previously.

The second level of essay questions called upon the pupil to **describe** some object, condition or process using their own words. It might be to describe the appearance or composition of some rock formation or cloud formation. These questions would sometimes ask the pupil to describe differences or similarities among conditions or processes which had been presented in previous illustrations or movie clips. Furthermore, at this level of questioning the program would ask a pupil to describe the events which led to a substantially different condition. The general impression was that this level of expectation was a notch above simply naming or listing a set of traits.

The third level of questioning which these student/authors displayed was one in which they asked the pupil to **explain** the meaning or the reasons for some condition which had been displayed during the IVD program. Sometimes this was a question asking for cause and effect relationships or

the meaning of events in a process. Sometimes, the pupil was asked to explain what results might be expected from a process or from changing some variable in the process. At other times, the student/author called for the pupil to offer an opinion and then explain the basis for that opinion.

Table 2 shows the relative proportion of questions asked by the student/authors in this small sample. Multiple-choice statements accounted for 37% of the 200 questions posed by the student/authors, while multiple-choice questions accounted for 26% of the questions. Essay-type questions amounted to 37% of all of the questions asked. When the 75 essay-type queries are considered separately, the table indicates that 48% of them were "naming" tasks, 27% were "describe" tasks and 25% were "explain" tasks.

DISCUSSION

The emergence of IVD and compact discs has generated a large number of authoring systems to support instructors. Heretofore, many reviews have summarized the strengths and deficiencies of these authoring tools. Additional critiques along this line are needed. However, in this paper we've attempted to step beyond the hardware/software disputes to estimate how groups of teachers might use an authoring system to teach.

We have reason to believe that the beginning teacher will develop programs which display a distinct pattern of interactivity. We've found some student/authors who use the AUTHOR system as an intriguing page turner which can call forth many nice pictures. We've found others who use it as a testing machine. There's another group of beginning teachers who seek a balance between providing information and collecting information from the

puipils who use the IVD program.

The level of questioning shows a heavy dependence upon the multiple-choice format. Sometimes, the format is a question with a correct answer embedded in a word, phrase or complete sentence. At other times the multiple-choice format is couched in a complete statement which matches one of the words or phrases in the set of options.

Essay-type questions are intended to give the pupils enough scope and opportunity to explain or describe their understanding of the topic. A careful reading of the pupil's responses to essay-type queries could provide important insights for a sensitive teacher.

However, when the essay-type questions are considered as one whole group, the majority of them called for naming items or characteristics or dates or places. A small number of student/authors asked for explanations of specific processes or conditions. Very few asked for hypotheses or guesses to explain a situation.

It would be an interesting study to follow some of the student/authors in this group to discover the types of questions which each one posed in their regular classroom instruction. The conventional wisdom is that an intructional design team requires 200 + hours to develop one hour of an IVD course. Perhaps that's reasonable for commercial grade programs. However, it appears that some talented and energetic teachers can develop brief IVD programs which they can tailor to support their respective plans for instruction. If a school district made a relatively modest investment of funds to purchase the equipment, an immaginative and energetic teacher could gradually build a susbtantial collection of IVD vignettes tailored to his/her specific purposes. It would also provide a broad base to collect empirical

evidence of the benefits and deficiencies of this facet of instructional technology.

Although this study found three types of questions asked by the student/authors and several levels within each category, it would be useful to explore a specific model of questioning as it might be applied in an IVD program. For example, Dantonio has recommended a model of focusing questions which relate to concept development in science education (Dantonio, 1987). Her model utilizes clarification questions, verification questions, support questions, and redirection questions to enable students to move from simple observation and description to an ordered system of classification of a particular process or condition.

It would be interesting to discover the extent to which IVD programs might be developed to implement a model such as Dantonio's. This is not to suggest that one would expect to implement the full range of questioning strategies. Accomplishments of that magnitude are still challenging researchers in artificial intelligence. However, it may be that an IVD program using existing science videodiscs could enable pupils to improve significantly their proficiency in one or more aspects of the questioning process, e.g. observation, classification.

In any event, the opportunities offered by IVD to support the instructional process are impressive. Instructional tasks which were bungled with the data processing resources of the 1960's should be revisted in terms of the information processing tools which are available now and building toward the 1990's.

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Table 1

Menu of Options Available for Student/Authors to Use to Create Interactive Videodisc Program

Function Key	Purpose of Option
HELP KEY	- Provide hints or suggestions to aid pupil
F1	- Enter a sequence of individual frames
F1	- [SHIFTED] Indicate beginning and ending frames of movie clip
F2	- Call for a graphic screen to be displayed
F2	- [SHIFTED] Suppress redisplay of the graphic screen
F3	- Call for prompts to enter an essay-type question
F4	- Call for prompts to enter a multiple-choice type question
F5	- Call for prompts to enter a multiple-response type question
F6	- Enter a statement or instructions for the pupil to read
F7	- Use keyboard to review frames on the laserdisc
F8	- Enter a conditional branch
F8	- [SHIFTED] Enter a section number into the program
F9	- Enter an unconditional branch into the program
F9	- [SHIFTED] Reset the correct response counter (to zero)
F10	- Exit from the program

Table 2

Types of Questions in Programs of Student/Authors

A. Multiple-choice Type Statements 74 (37%)

1. Complete statement with 1-word options
2. Complete statement with phrase options
3. Complete statement with complete sentence options

B. Multiple-choice Type Questions 52 (26%)

1. Questions with 1-word options
2. Questions with phrase options
3. Questions with complete sentence options

C. Essay-type Questions 74 (37%)

1. Name or state a set of terms (.48)
    a. Name term to match picture, definition
    b. Name 2 or more items in a process, condition
    c. Name events leading to some condition
2. Describe an Object, Condition or Process (.27)
    a. Describe appearance of Object
    b. Describe differences or similarities of objects
    c. Describe events leading to some condition
3. Explain the Meaning of Some Condition or Process (.25)
    a. Explain reasons for some existing condition
    b. Explain cause/effect relation leading to condition
    c. Explain meaning of events in some process
    d. Explain results to be expected from some process
    e. Explain results to be expected from change in variable
    f. Explain basis for arriving at a particular conclusion

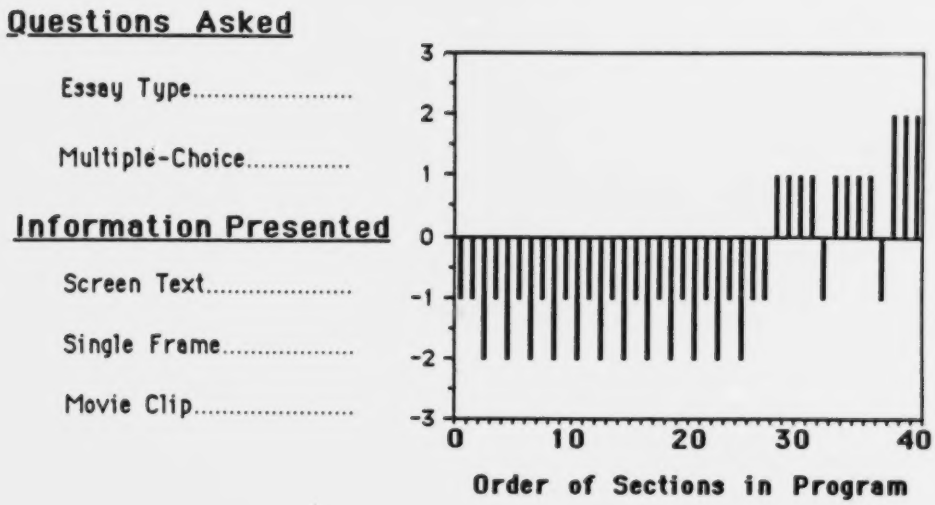

Figure 1. Information Presented vs Questions Asked in CP.VOL Program

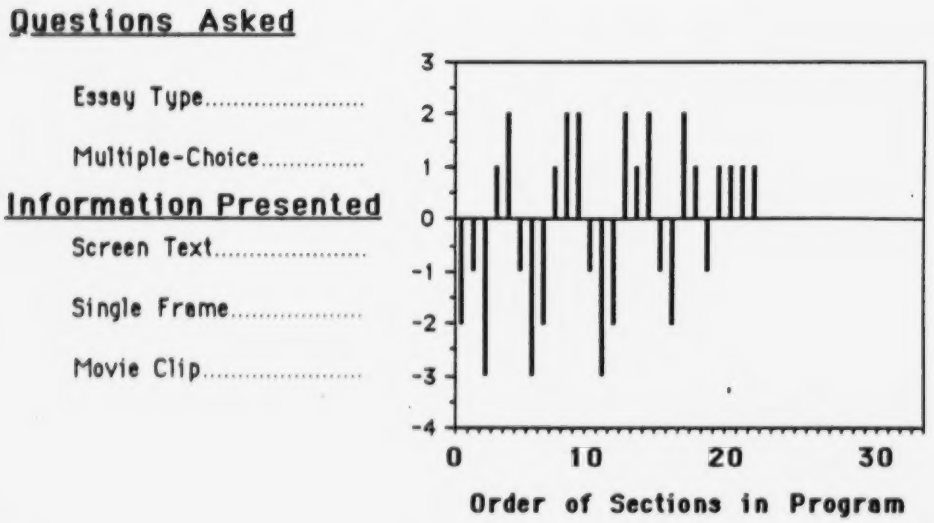

Figure 2. Information Presented vs Questions Asked in FJ.Rock Program

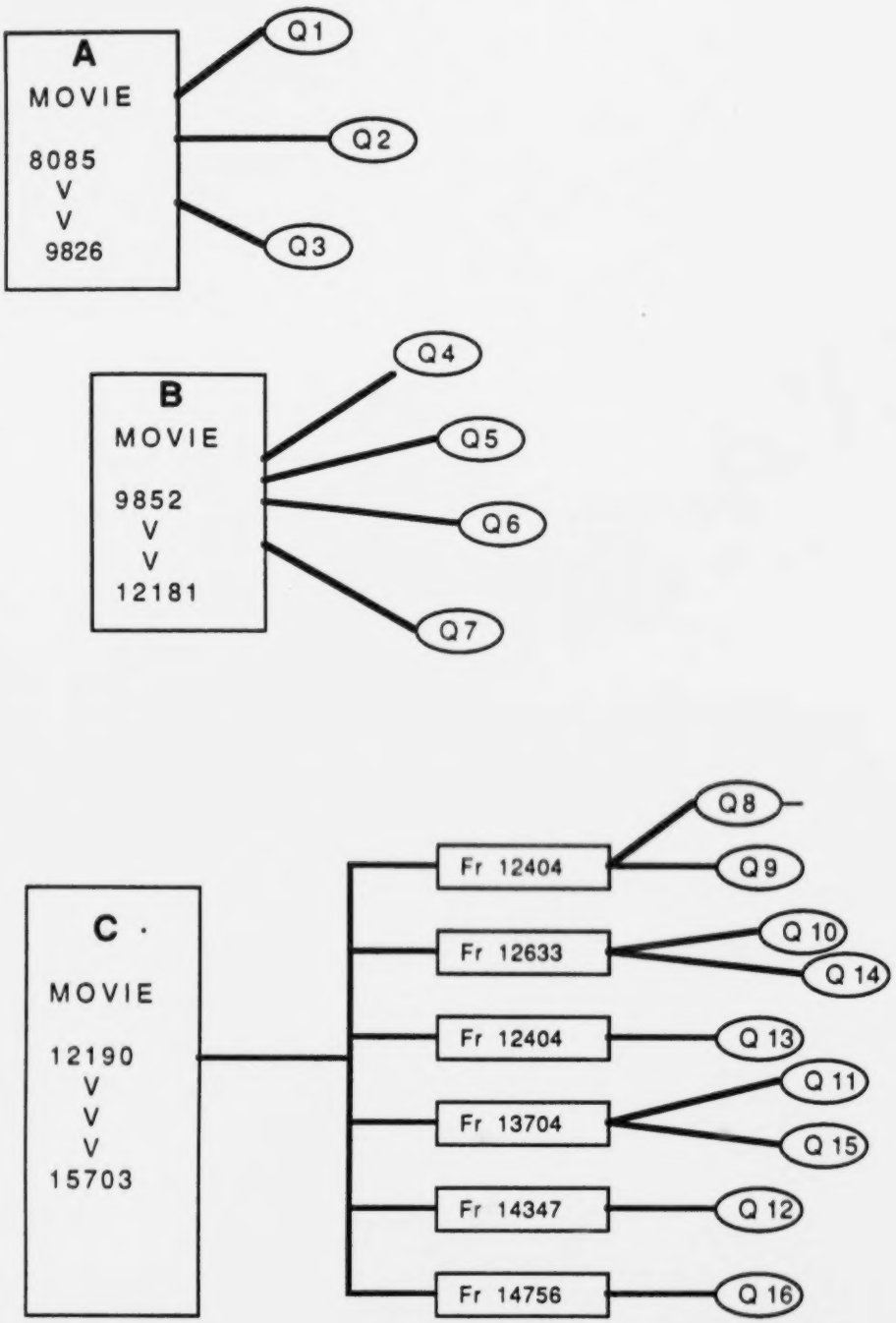

Figure 3. Sequence of Movie Clips, Single Frames, and Related Questions

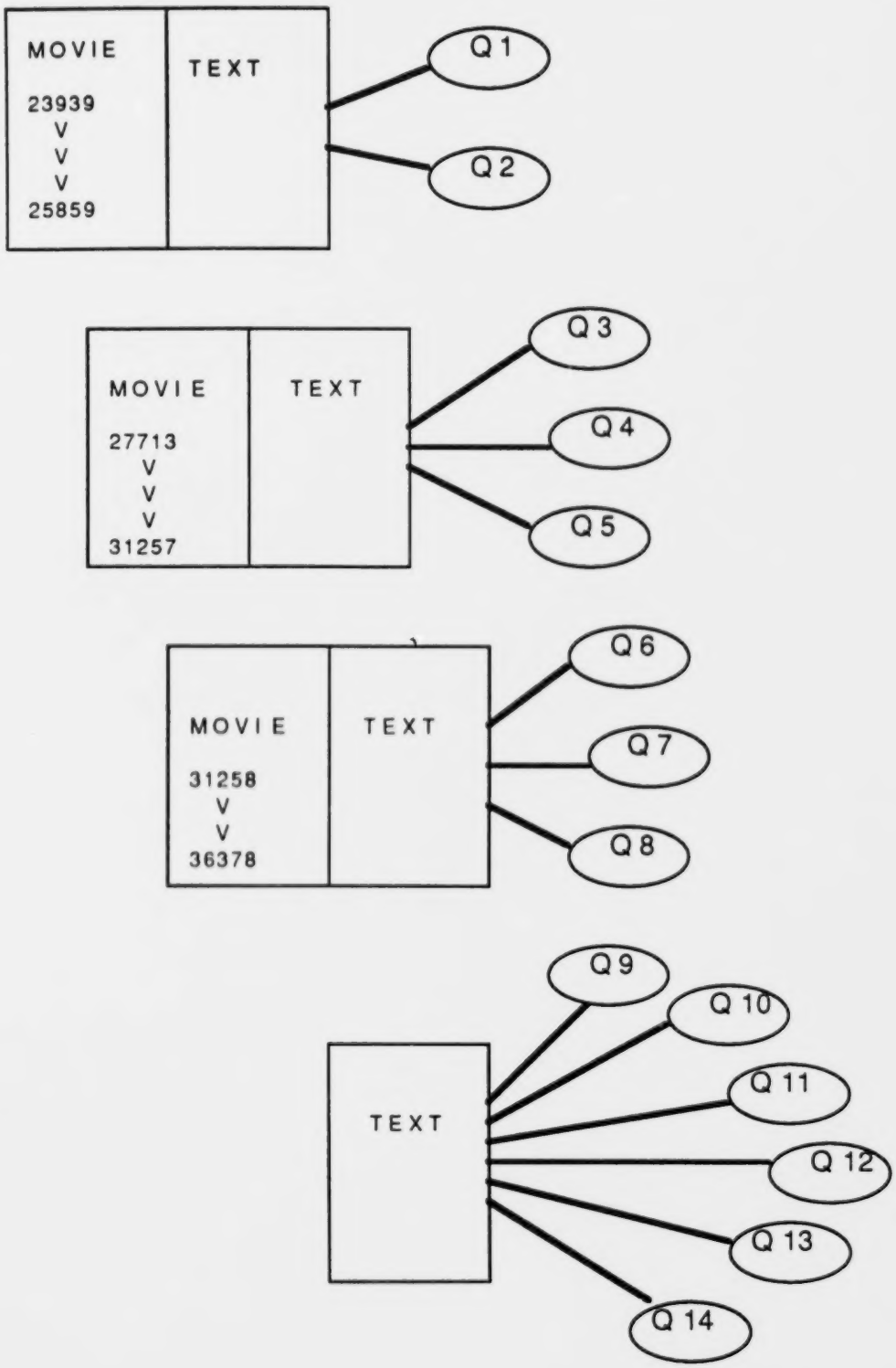

Figure 4. Sequence of Movie Clips, Text on Screen of Microcomputer and Related Questions